Booster/Linac Studies Summer 2002

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Outline

- Booster low emittance studies results and analysis (Sereno, Sajaev)
- Booster software development/testing (Sereno, Shang, Soliday)
- Linac matching studies using the PC Gun (Sereno, Borland, Emery)

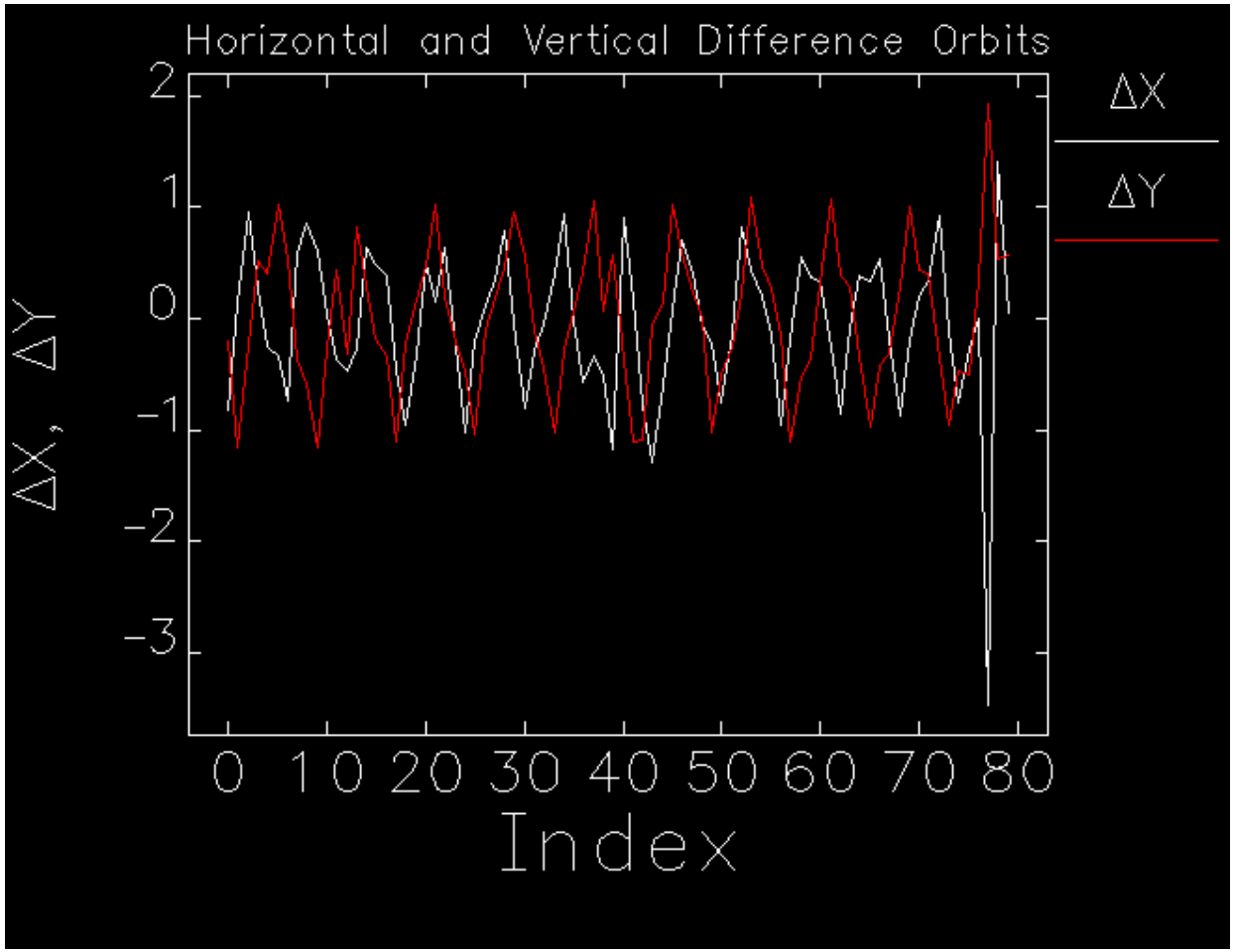
Booster Low Emittance Studies

- Start with the standard booster lattice
  - $\nu_x = 11.75, \nu_y = 9.80$
  - $\epsilon_x = 131\, nm$
- Set quadrupole/sextupole family strength (ramp slopes) from **elegant**
- Measure integer and fractional tunes and correct
- Correct the orbit (injection and extraction presently).
- Adjust sextupole strength (ramp slope and zero crossing) to set chromaticity (SD)

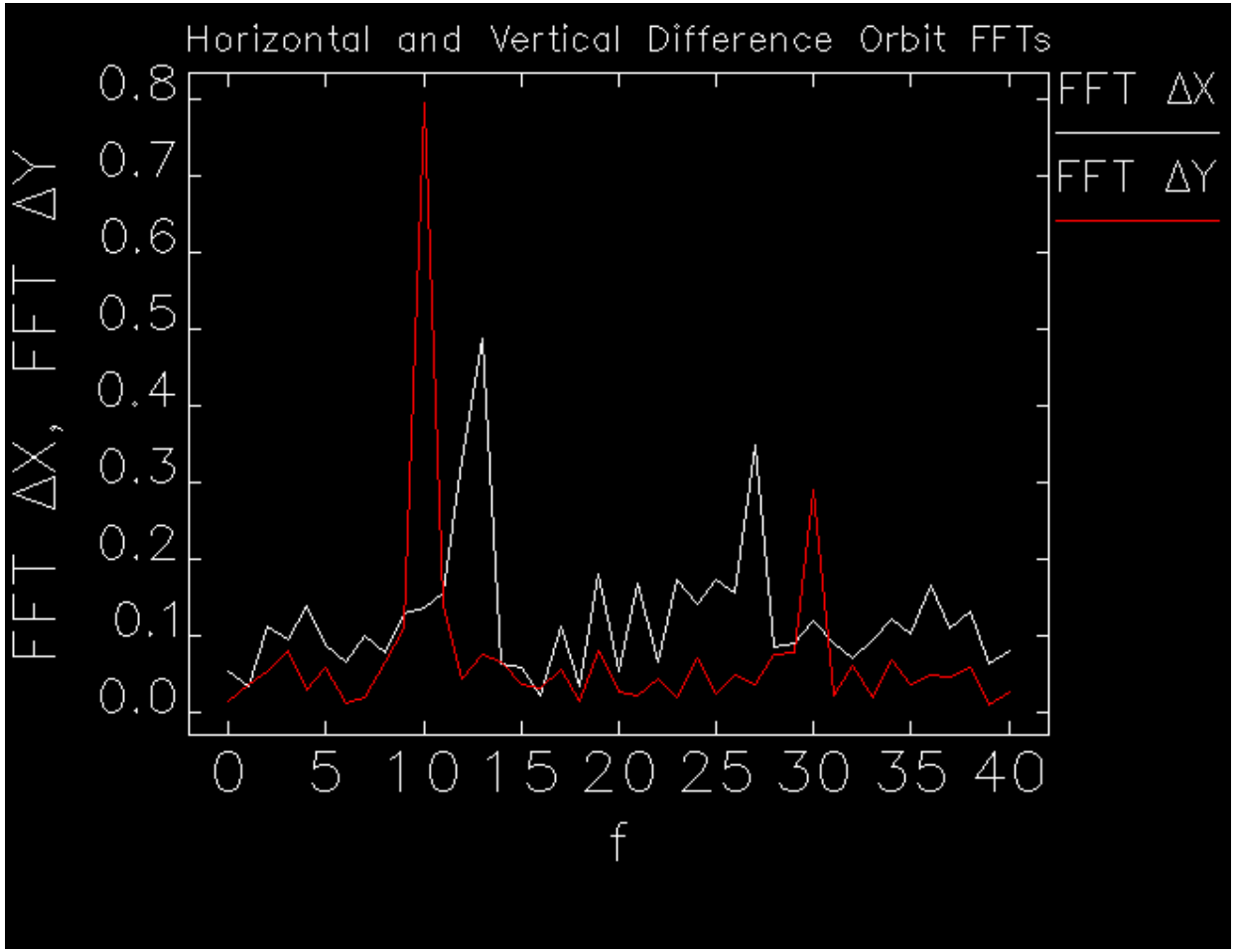
Booster Low Emittance Studies

- Low emittance lattice parameters achieved (July 2002)
  - $\nu_x = 12.75, \nu_y = 9.80$
  - $\epsilon_x = 109\, nm$
- Studies continuing for lower emittances
  - Increase horizontal tune (13.25 - 13.75)
  - Decrease vertical tune (5.2 - 8.8)
- Keeps SD strength manageable
- Goal is to achieve $\epsilon_x \approx 90\, nm$
- V. Sajaev is analyzing response data for both lattices *BPM Gains*

Orbit Response Data



Orbit Response Data FFT



Booster Software Development and Testing

- Rewrite booster orbit correction sofware to use standard OAG tools (Shang)
  - Use SR orbit correction interface and lattice management
  - Easy inverse matrix computation for various lattices
  - Easy elimination of bad bpms/correctors
  - Orbit correction at arbitrarily number of points along the ramp (under development)
- Migrate related booster software to standard tools: response matrix measurement, bump generator, corrector checkout, bpm configuration etc. (Shang)

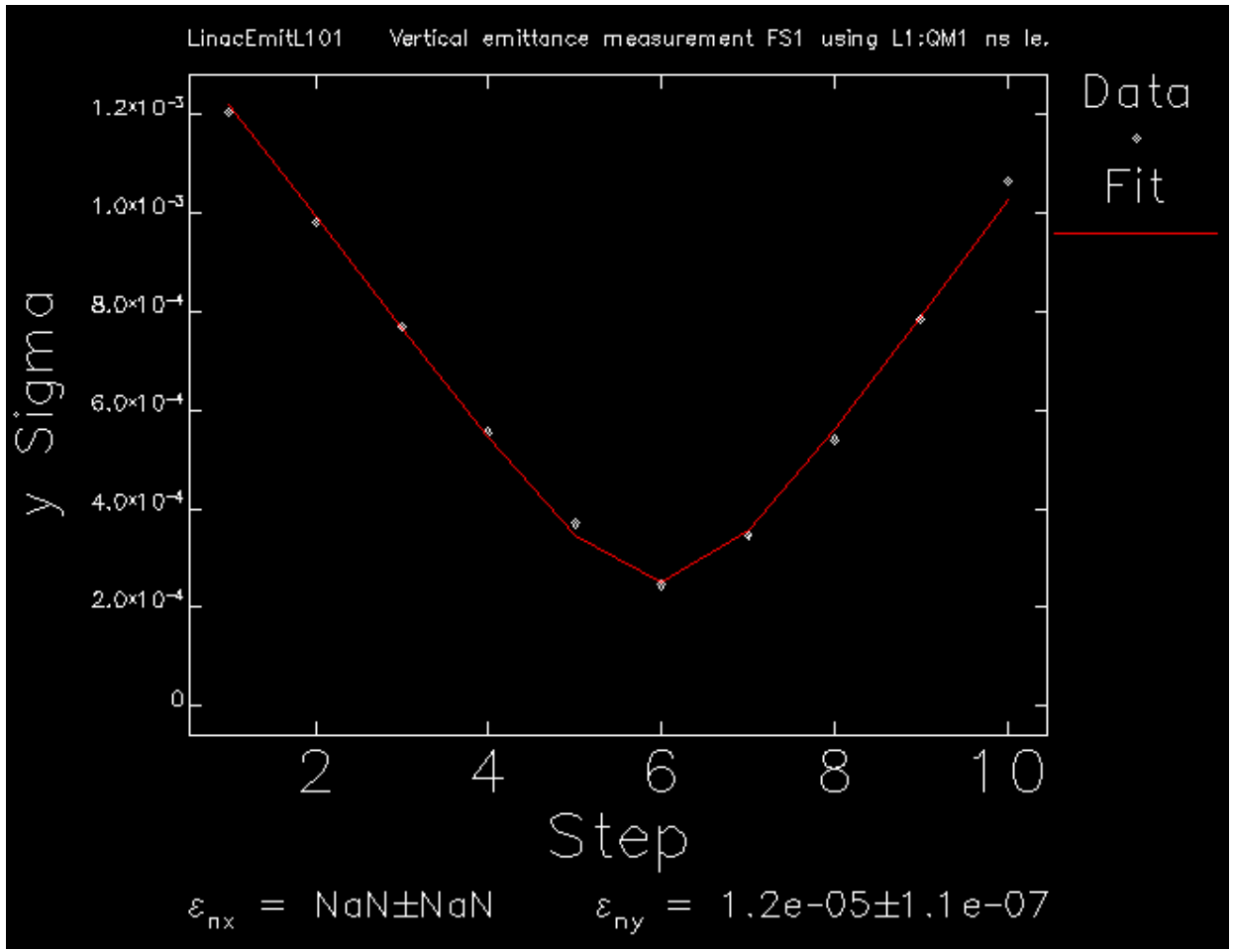
Booster Software Development and Testing cont.

- Now have a choice of standard and low emittance lattices (Running low emittance lattice since July)
- Update booster PEM (ready to test, Soliday)
  - PEM brings up SCR to allow operator choice of saveset corresponding to a particular lattice
  - PEM automatically loads proper lattice corrector ramps (QF and QD slope references)
- SCR now has standard and low emittance reference and operator preferred files (Sereno)
- BTS emittance measurement (Sereno, Soliday)

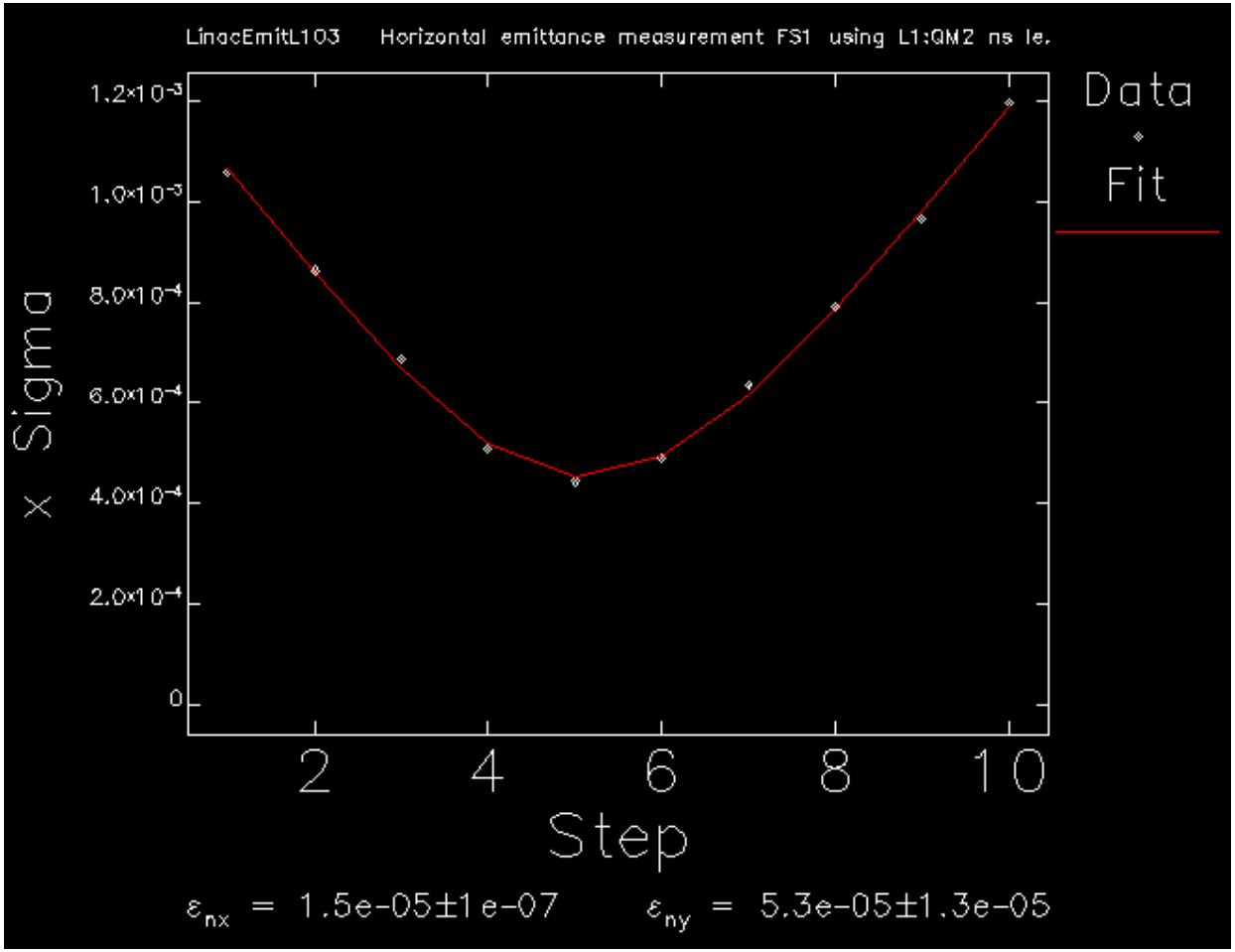
Linac matching studies using the PC Gun

- Measured emittance using quads and flag at entrance to L2 (L1:QM1, L1:QM2, LI:FS1)
- Measured L1 energy using corrector and flag using APSMeasureL1Momentum (35.7 MeV)
- Propagate measured beta functions through L2 to BC-3 screen emittance measurement (APSPropagateMeasuredTwissLIFS1)
- Rematch to BC 3 screen design betas using L1, L2 and L3 quads. (APSMatchFromMeasuredTwissLIFS1)

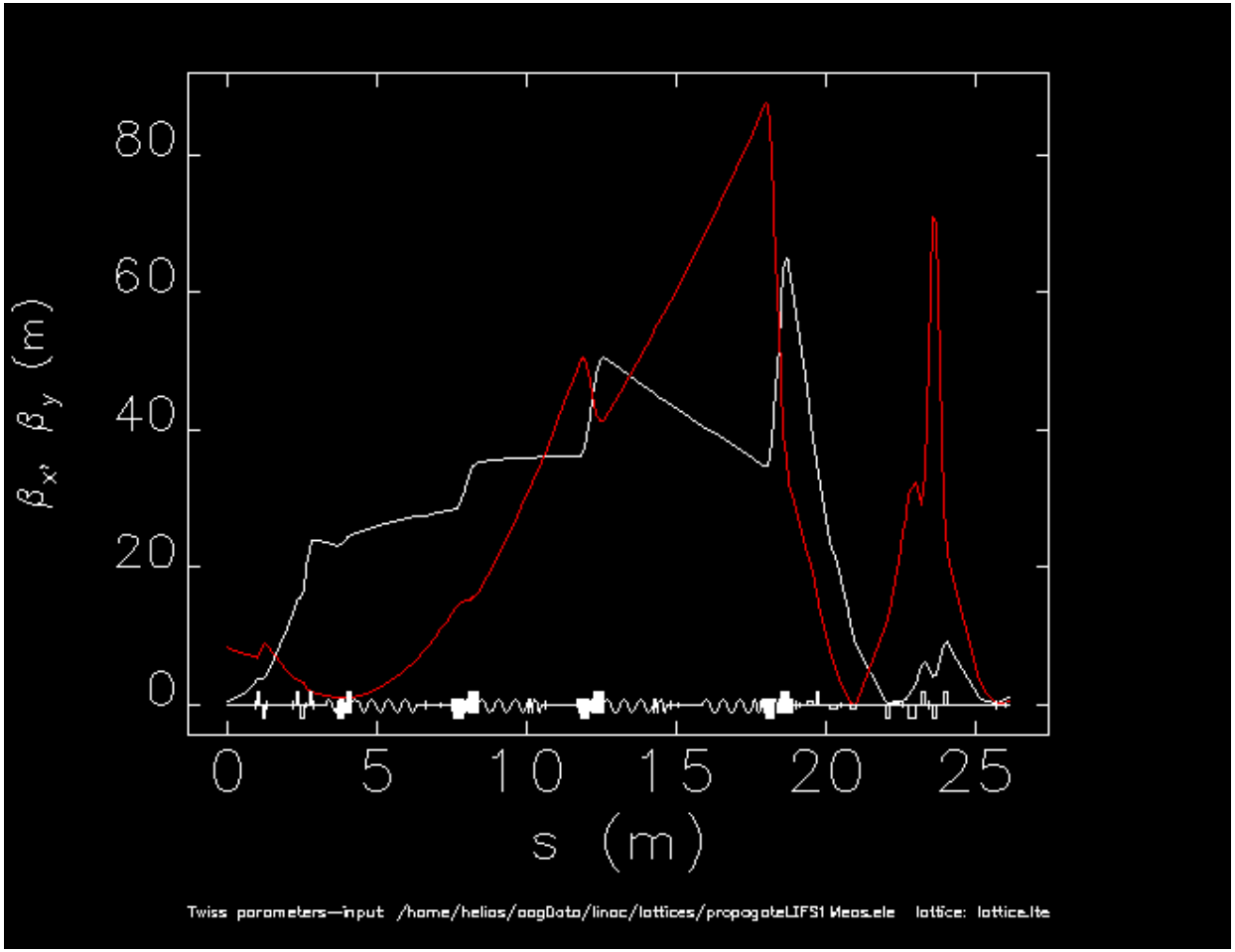
L1 Quad Scan Vertical Emittance Data



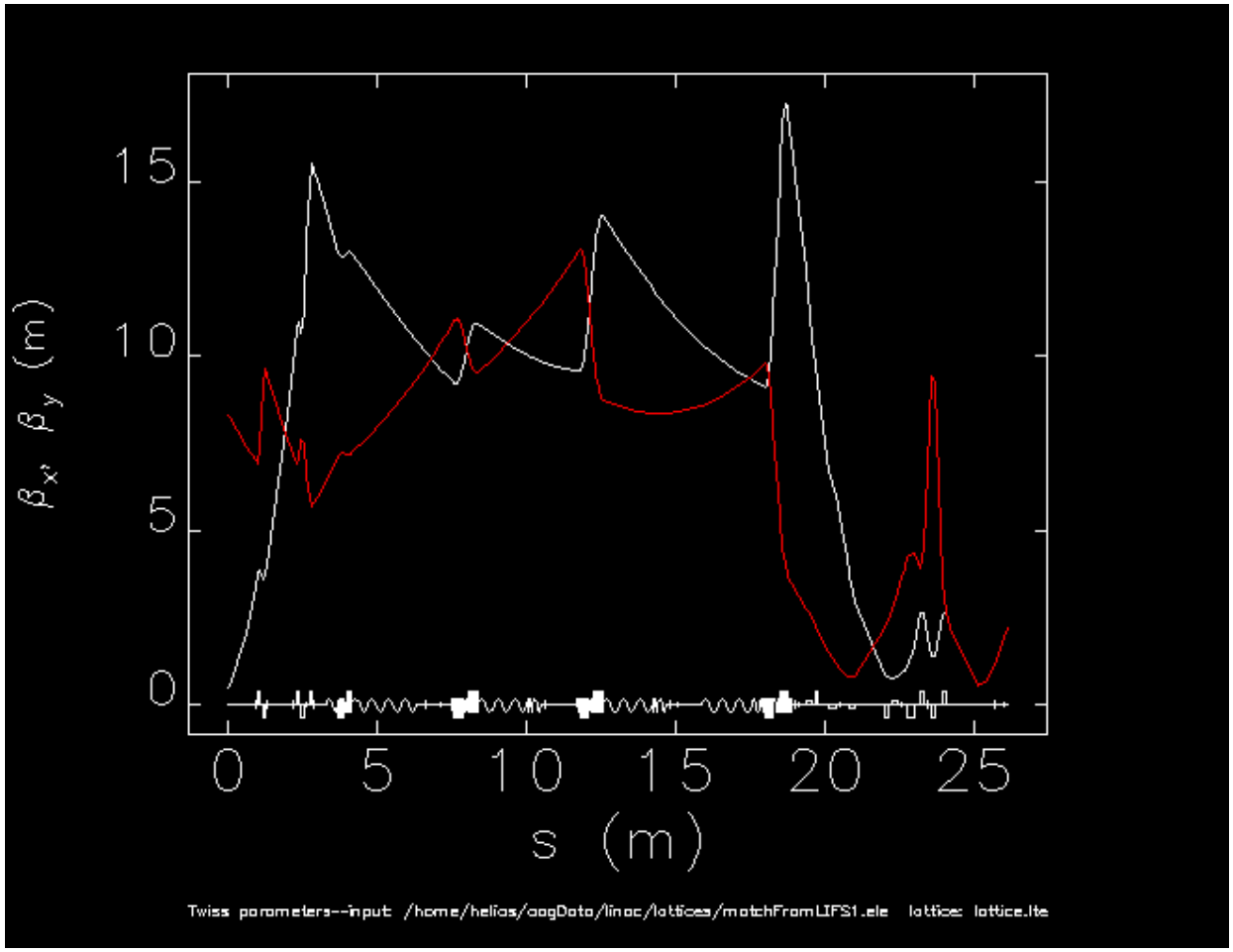
L1 Quad Scan Horizontal Emittance Data



Beta Function Propagation through L2



Beta Function Propagation through L2 After Matching



Conclusions

- Booster low emittance lattice studies continue
  - Goal is to achieve a 90 nm lattice for operations
  - Related software development/testing continues
- Performed linac emittance and matching measurements
  - Large beta functions through L2 - BC can give trouble with wakefields at BC 3 screen measurement
  - May make matching difficult or impossible at BC
  - **Elegant** matching using all L1, L2 and L3 quads converged, however, mismatch at BC-3 screen seen
  - Need further studies to determine best matching strategy and double check results of scripts